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(54) Title: MINERAL FIBRES

(57) Abstract

Fibres with the following composition: SiO_2 47-54 % by weight, Al_2O_3 4-7.5 % by weight, Fe_2O_3 1-8.5 % by weight, CaO 10-24.5 % by weight, MgO 10-21 % by weight, Na_2O 0.1-10 % by weight, K_2O 0.1-1.5 % by weight soluble in salt solutions.

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Mineral fibres

The present invention relates to a novel type of mineral fibres.

Conventional mineral fibres are produced from naturally occuring materials and therefore the costs of raw materials are relatively low.

Such known mineral fibres typically have the following composition:

SiO_2	about	45	% by weight
Al_2O_3	-	13.5	-
FeO	-	5.5	-
CaO	-	20.5	-
MgO	-	10.5	-
TiO	-	1.0	-
$Na_2O + K_2O$	-	2.5	-

The known mineral fibres are characterized by their high temperature resistance, but they are only slightly affected by salt solutions. Therefore they degrade very slowly when deposited at a tip or in other places in nature after use.

The specification of NO patent application No. 874323 (Manville Corporation) describes inorganic fibres serving as a substitute for conventional mineral wool fibres and containing MgO in an amount of 0.1-30 % by weight and Al_2O_3 in an amount of 0-10 % by weight in addition to SiO_2 and CaO. According to the above-mentioned patent application said fibres, which are mainly characterized in having a relatively low content of Al_2O_3, are considerably more soluble in salt solutions than conventional mineral fibres, e.g. in the so-called Gamble's solution, i.e. an aqueous solution containing the following salts in a dissolved form:

Component	Concentration g/l
$MgCl_2 . 6H_2O$	0.160
NaCl	6.171
KCl	0.311

Na_2HPO_4	0.149
Na_2SO_4	0.079
$CaCl_2$, $2H_2O$	0.060
$NaHCO_3$	1.942
$NaC_2H_3O_2$	1.066

An essential drawback of the known soluble fibres is that they are produced from relatively expensive oxides and not from naturally occuring raw materials.

Furthermore some of the known fibres have a relatively poor heat resistance and are consequently unsuitable for use at high temperatures.

Surprisingly it has been found that mineral fibres with a considerably greater solubility in salt solutions than the above-mentioned known mineral fibres, and which at the same time exhibit an acceptable high temperature resistance can be produced from naturally occuring raw materials and other inexpensive raw materials.

Mineral fibres according to the invention are characterized in having the following composition:

SiO_2	47-54	% by weight
Al_2O_3	4-7.5	-
Fe_2O_3	1-8.5	-
CaO	10-24.5	-
MgO	10-21	-
Na_2O	0.1-10	-
K_2O	0.1-1.5	-

the total content of SiO_2, Al_2O_3 and Fe_2O_3 not exceeding 65 % by weight.

Mineral fibres of the above-mentioned composition can be produced from naturally occuring raw materials and other readily obtainable and inexpensive materials such as waste products from the production of mineral wool fibres and glass. Examples of such raw material compositions are listed in Table I.

Table I

Raw material composition

1		Diabase	70 %
		Cement briquettes[1)]	30 %
2		Diabase	20 %
		Clay briquettes[2)]	80 %
3		Cement briquettes[3)]	80 %
		Olivine-containing diabase	20 %
		Clay briquettes consisting of:	
4		Clay	45 %
		Sand	22 %
		Olivine sand	22 %
		Rasorite (Sodium borate)	8 %
		Blast-furnace slag	8 %
		Iron oxide	3 %
		Clay briquettes consisting of:	
5		Clay	50 %
		Rock wool waste	10 %
		Lime	20 %
		Sand	10 %
		Olivine sand	10 %
		Clay briquettes consisting of:	
6		Clay	50 %
		Lime	20 %
		Sand	10 %
		Olivine sand	10 %
		Soda	10 %
		Cement briquettes consisting of:	
7		Olivine	53 %
		Glass waste from the production of glass bottles	35 %

Cement 12 %

1) Consisting of 12 % cement, 40 % mineral wool waste, 5 % dolomite and 43 % diabase.

2) Consisting of 50 % clay, 30 % mineral wool waste, 15 % olivine sand and 5 % iron oxide slag.

3) Consisting of 15 % cement, 23 % mineral wool waste, 22 % sand, 10 % olivine sand, 30 % olivine-containing diabase.

The solubility of the mineral fibres of the invention and known fibres has been examined by storing fibre samples weighing 830 mg in 250 ml of said Gamble's solution for 5 hours at a temperature which was increased from 37°C to 60°C and by measuring the SiO_2-concentration of the solution at the end of the test.

The results obtained will appear from Table II.

Table II

	Known Mineral Fibres		Mineral fibres according to the invention			
Composition	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
SiO_2	44.6	49.0	50.5	54.2	50.8	47.2
Al_2O_3	13.3	10.3	5.8	5.9	6.2	6.9
TiO_2	1.1	2.2	0.6	0.4	0.4	0.4
Fe_2O_3	6.1	8.0	7.9	5.0	2.3	3.0
CaO	20.3	14.3	11.8	9.8	24.4	20.7
MgO	10.6	11.8	20.0	17.0	12.7	14.4
Na_2O	2.0	1.7	0.2	2.2	0.5	6.5
	0.5	1.6	0.5	1.1	1.3	0.7
B_2O_3				3.2		

Solubility, ppm						
SiO_2	3.74	1.84	8.22	4.79	12.88	10.80

As will appear from the above Table II the mineral fibres according to the invention have a considerably higher solubility in the salt solution than the conventional known fibres.

A fibre sample according to NO patent application No. 874323 was subject to a similar examination. The fibres had the following composition:

SiO_2	50.2 % by weight
Al_2O_3	10.0 -
TiO_2	0.3 -
Fe_2O_3	0.7 -
CaO	27.9 -
MgO	6.8 -
Na_2O	0.2 -
K_2O	0.7 -

A solubility corresponding to a SiO_2-concentration of 3.16 ppm was measured which is also considerably less than the solubility of the fibres of the invention.

It could be feared that mineral fibres with a relatively high solubility in salt solutions would be sensitive to heat and therefore would be unsuitable for use at high temperatures and that they lack the necessary fire resistance. However, tests have shown that this fear is groundless in respect of the fibres according to the invention.

The tests were carried out with mineral fiber samples weighing from 0.5 to 1 g. These samples were placed on a refractory plate and then inserted into an oven which was preheated to a given temperature. After 30 minutes in the oven at this given temperature the fibre samples were removed from the oven and examined. If the dimensions,

structures and elasticity of the fibres were unchanged this was taken as an indication of the fibres being resistant at the given temperature.

If it was found that the fibres were brittle (sintered), a new sample was subject to a similar treatment at a temperature which was 25°C below the one tried first.

If necessary the test was repeated with a further reduction of the temperature until the fibres remained unchanged.

The examination of the mineral fibres according to the invention (tests 3-6) listed in Table II showed that they were all resistant at a temperature higher than 750°C which corresponds to the temperature resistance of the mineral fibre sample according to NO patent application No. 874323.

Mineral fibres according to the invention with a composition within the following limits:

SiO_2	47-51	% by weight
Al_2O_3	5-7	-
Fe_2O_3	2-4	-
CaO	15-21	-
MgO	10-15	-
Na_2O	0.5-7	-
K_2O	0.5-1.5	-

exhibit a particularly high solubility in salt solutions.

Patent claims

1. Mineral fibres, characterized in having the following composition:

SiO_2	47-54	% by weight
Al_2O_3	4-7.5	-
Fe_2O_3	1-8.5	-
CaO	10-24.5	-
MgO	10-21	-
Na_2O	0.1-10	-
K_2O	0.1-1.5	-

2. Mineral fibres according to claim 1, characterized in having the following composition:

SiO_2	47-51	% by weight
Al_2O_3	5-7	-
Fe_2O_3	2-4	-
CaO	15-21	-
MgO	10-15	-
Na_2O	0.5-7	-
K_2O	0.5-1.5	-

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I CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [illegible]

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II FIELDS SEARCHED

Minimum Documentation Searched [illegible]

Classification System	Classification Symbols
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III DOCUMENTS CONSIDERED TO BE RELEVANT [illegible]

Category *	Citation of Document, [illegible] with indication, where appropriate, of the relevant passages [illegible]	Relevant to Claim No [illegible]
A	US, A, 2 576 312 (LEONARD JOHN MINNICK) 27 November 1951	
A	GB, A, 2 152 026 (INSTITUT FUR MINERALISCHE ROHSTOFF-UND LAGERSTATTENWIRTSCHAFT) 31 July 1985	
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IV CERTIFICATION

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